Create	**5**

Mapping of CLOs to PLOs

CLOs	PLO10	PLO11	PLO12	PLO13	PLO14	PLO15	PLO16	PLO17	PLO18
CLO1	1	1	0	0	0	0	0	1	0
CLO2	1	1	0	0	0	0	0	1	1
CLO3	1	1	0	0	0	0	0	1	1
CLO4	1	1	0	0	0	0	0	1	1
CLO5	1	1	0	0	0	0	0	1	1
CLO6	1	1	0	0	0	0	0	1	1

Part D- Resources

Textbooks

3. Online resources: w3schools.com, stackoverflow.com, codeforces.com etc.
4. Online tutorial from udemy, youtube.com etc.

Jashore University of Science and Technology
Faculty of Science and Engineering
Department of Computer Science and Engineering

Course Outline: Algorithm Analysis and Design

Part A- Introduction

I.Course code: CSE 2201	
II.Credit: 3	

1.Course Summary	
Algorithm analysis and design provide the theoretical backbone of computer science and are a must in the daily work of the successful programmer. This course applies design and analysis techniques to numeric and nonnumeric algorithms which act on data structures. Design is emphasized so that the student will be able to develop new algorithms. Analysis of algorithms is concerned with the resources an algorithm must use to reach a solution.	

2.Course Objectives

1. The goal of this course is to provide a solid background in the design and analysis of the major classes of algorithms.
2. To become familiar with the tools and techniques necessary to propose practical algorithmic solutions to real-world problems which still allow strong theoretical bounds on time and space usage.
3. To introduce a broad variety of important and useful algorithms and data structures in different areas of applications and to concentrate on fundamental algorithms.
4. At the end of the course students will be able to develop their own versions for a given computational task and to compare and contrast their performance.

3.Course Learning Outcomes

CLO1. Understand theoretical and mathematical structures, concepts of computer algorithms
CLO2. Analyze the time complexity, space complexity, asymptotic performance of algorithms, worst, average and best-cases of algorithms. .
CLO3. Demonstrate numerous algorithm design strategies including divide and conquer, greedy method, dynamic programming, backtracking, finding shortest paths, traversing salesmen, and implementing those algorithms.
CLO4. Illustrate and analyze various search and graph algorithms, graph coloring, branch and bound algorithms, Hamiltonian cycle.
CLO5. Evaluate decision problems, the concept of P = NP, NP completeness and Cook's theorem.

Part B- Lesson Plan

Course Details Learning plan

Timeline	Topics /contents	Learning Outcomes	Mapped CLOs	Teaching Strategies	Assessment Strategies
Week 1	algorithms, basic notations of algorithms, fundamental analysis of algorithms, criteria of algorithms	Discuss about the basic structure of algorithms, notations of algorithms, proof techniques	CLO1	Lecture	Quiz

Week 2	fundamental analysis of complexity, different asymptotic notation, efficiency worst case best case and average case analysis	Solving the problems of asymptotic notation, Apply asymptotic notation to represent algorithm complexity	CLO1, CLO2	Lecture, Exercise Demonstration	Quiz, Assignment, Exam
Week 3	Elementary Data Structures Divide and Conquer algorithms merge sort heap sort maxmin algorithm quick sort	Searching strategy using divide and conquer, different types of sorting algorithms with example	CLO3	Lecture, Exercise Demonstration	Quiz, Assignment, Exam
Week 4, 5	Greedy algorithms, Knapsack Problem, Job Sequencing with deadlines, MST Kruskal's algorithms, Prim's algorithms	Discuss about greedy method control abstraction, discuss about the algorithms with example, Demonstrate how to find MST using Prims and Kruskals algorithm.	CLO3	Lecture, Exercise Demonstration	Quiz, Assignment, Exam
Week 6, 7	Dynamic Programming, Matrix Chain Multiplication, Optimal Binary search tree, Multistage Graph, Bellman Ford Algorithm	Discuss about the Dynamic Programming basics, Solve the multistage graph algorithm for showing the application of DP	CLO3	Lecture, Exercise Demonstration	Quiz, Assignment, Exam

Week 8, 9	Huffman Code Shortest path problem, Floyd's Algorithm, Sequence Alignment Backtracking N Queen Problem, State Space tree	Solve Huffman code and shortest path problem, the process of sequence alignment, understand the concept of backtracking, Understand about the 4-queen problem and state space tree.	CLO3	Lecture, Exercise Demonstration	Quiz, Assignment Exam
Week 10, 11	Travelling salesman Problem, Branch and Bound, Sum of subset problem, Hamiltonian cycle, planar graph, graph coloring,	understand sum-of subset method, learn planar graph, graph coloring, Hamiltonian cycle. Understand branch and bound work,	CLO3, CLO4	Lecture Exercise Demonstration	Quiz, Assignment, Exam
Week 12	Traversal and search techniques, BFS, DFS	Understand how traversal techniques work, analyze the BFS and DFS for graph	CLO4	Lecture, Exercise Demonstration	Quiz, Assignment, Exam
Week 13, 14	NP-Completeness, Cook's theorem NP- Complete problem	P and NP (Cook's theorem),examples of NP-complete problems; approximate algorithms for NP-hard problems or polynomial algorithms for sub problems of NP-hard problems	CLO5	Lecture, Exercise Demonstration	Quiz, Assignment, Exam

Part C- Assessment and Evaluations

Assessment Procedures

Assessment Name	Description
Quiz	Quizzes are simple class tests with a duration from 20 minutes to 120 minutes. It can be online or offline, students need to prepare for the quiz based on the instructed syllabus.
Assignment	Type of home work assessment, students are given specific tasks and instructed to complete them within a given period of time.
Attendance	Student's participation in the class lecture, quiz and exam.
Exam	Each course contains a final exam considering the complete syllabus. It should be a 3hours exam for 72 marks. Students need to answer at most 6 questions. Every question may include sub questions

Mapping of CLOs to Assessment

CIE- Continuous Internal Evaluation (28 Marks):

Bloom's Category Marks (out of 20)	Test (10)	Assignment (5)	Quizzes (5)	External Participation in Curricular/Co-Curricular Activities
Remember	2			
Understand	5			
Apply	3			
Analyze	2			
Evaluate	4			
Create	4			

SEE-Semester End Examination (72 Marks)

Bloom's Category	Test
Remember	05
Understand	15

Apply	20
Analyze	10
Evaluate	10
Create	12

Mapping of CLOs to PLOs

CLOs	PLO19	PLO20	PLO21	PLO22	PLO23	PLO24	PLO25	PLO26	PLO27
CLO1	1	1	1	0	0	0	0	1	0
CLO2	1	1	1	0	0	0	0	1	1
CLO3	1	1	1	0	0	0	0	1	0
CLO4	1	1	1	0	0	0	0	1	1
CLO5	1	1	1	0	0	0	0	1	0

Part D- Resources

Textbooks

1. *Horowitz, Sahni, Rajasekaran: Fundamentals of Computer Algorithms*
2. *Thomas H. Cormen, Charles E. Leiserson and Ronald L. Rivest: Introduction to Algorithms*

Reference Books

1. *Aho, Hopcroft and Ullman: The design and Analysis of Computer Algorithms*
2. *Sara Baase: Computer Algorithms: Introduction to Design and Analysis*
3. *D. E. Knuth: The Art of Computer Programming, Vol. 1, Fundamental Algorithms.*

Jashore University of Science and Technology
Faculty of Science and Engineering
Department of Computer Science and Engineering

Course Outline: Algorithm Analysis and Design Lab

Part A- Introduction

I.Course code: CSE 2202	
II.Credit: 1.5	

1.Course Summary	

Algorithm analysis and design provide the theoretical backbone of computer science and are a must in the daily work of the successful programmer. This course applies design and analysis techniques to numeric and nonnumeric algorithms which act on data structures. Design is emphasized so that the student will be able to develop new algorithms. Analysis of algorithms is concerned with the resources an algorithm must use to reach a solution.

2.Course Objectives

1. The goal of this course is to provide a solid background in the design and analysis of the major classes of algorithms.
2. To become familiar with the tools and techniques necessary to propose practical algorithmic solutions to real-world problems which still allow strong theoretical bounds on time and space usage.
3. To introduce a broad variety of important and useful algorithms and data structures in different areas of applications and to concentrate on fundamental algorithms.
4. At the end of the course students will be able to develop their own versions for a given computational task and to compare and contrast their performance.

3.Course Learning Outcomes

CLO1. Understand theoretical and mathematical structures, concepts of computer algorithms
CLO2. Analyze the time complexity, space complexity, asymptotic performance of algorithms, worst, average and best-cases of algorithms. .
CLO3. Demonstrate and implement numerous algorithm design strategies including divide and conquer, greedy method, dynamic programming, backtracking, finding shortest paths, traversing salesmen, and implementing those algorithms.
CLO4. Illustrate and apply various search and graph algorithms, graph coloring, branch and bound algorithms, Hamiltonian cycle.
CLO5. Evaluate decision problems, the concept of P = NP, NP completeness and Cook's theorem.

Part B- Lesson Plan

Course Details Learning plan

Timeline	Topics /contents	Learning Outcomes	Mapped CLOs	Teaching Strategies	Assessment Strategies

Week 1	algorithms, basic notations of algorithms, fundamental analysis of algorithms, criteria of algorithms	Discuss about the basic structure of algorithms, notations of algorithms, proof techniques	CLO1	Lecture	Quiz
Week 2	fundamental analysis of complexity, different asymptotic notation, efficiency worst case best case and average case analysis	Solving the problems of asymptotic notation, Apply asymptotic notation to represent algorithm complexity	CLO1, CLO2	Lecture, Exercise Demonstration	Quiz, Assignment, Exam
Week 3	Elementary Data Structures Divide and Conquer algorithms merge sort heap sort maxmin algorithm quick sort	Searching strategy using divide and conquer, different types of sorting algorithms with example	CLO3	Lecture, Exercise Demonstration	Practical, Assignment, Exam
Week 4, 5	Greedy algorithms, Knapsack Problem, Job Sequencing with deadlines, MST Kruskal's algorithms, Prim's algorithms	Discuss about greedy method control abstraction, discuss about the algorithms with example, Demonstrate how to find MST using Prims and Kruskals algorithm.	CLO3	Lecture, Exercise Demonstration	Practical, Assignment, Exam

Week 6, 7	Dynamic Programming, Matrix Chain Multiplication, Optimal Binary search tree, Multistage Graph, Bellman Ford Algorithm	Discuss about the Dynamic Programming basics, Solve the multistage graph algorithm for showing the application of DP	CLO3	Lecture, Exercise Demonstration	Practical, Assignment, Exam
Week 8, 9	Huffman Code Shortest path problem, Floyd's Algorithm, Sequence Alignment Backtracking N Queen Problem, State Space tree	Solve Huffman code and shortest path problem, the process of sequence alignment, understand the concept of backtracking, Understand about the 4-queen problem and state space tree.	CLO3	Lecture, Exercise Demonstration	Quiz, Practical, Assignment Exam
Week 10, 11	Travelling salesman Problem, Branch and Bound, Sum of subset problem, Hamiltonian cycle, planar graph, graph coloring,	understand sum-of subset method, learn planar graph, graph coloring, Hamiltonian cycle. Understand branch and bound work,	CLO3, CLO4	Lecture Exercise Demonstration	Quiz, Practical, Assignment, Exam
Week 12	Traversal and search techniques, BFS, DFS	Understand how traversal techniques work, analyze the BFS and DFS for graph	CLO4	Lecture, Exercise Demonstration	Quiz, Practical, Assignment, Exam

Week 13, 14	NP-Completeness, Cook's theorem NP- Complete problem	P and NP (Cook's theorem),examples of NP-complete problems; approximate algorithms for NP-hard problems or polynomial algorithms for sub problems of NP-hard problems	CLO5	Lecture, Exercise Demonstration	Quiz, Practical, Assignment, Exam

Part C- Assessment and Evaluations

Assessment Procedures

Assessment Name	**Description**
Quiz	Quizzes are simple class tests with duration from 20 minutes to 120 minutes. It can be online or offline, students need to prepare for the quiz based on the instructed syllabus.
Assignment	Type of home work assessment, students are given specific tasks and instructed to complete them within a given period of time.
Attendance	Student's participation in the class lecture, quiz and exam.
Practical	Mostly related to laboratory works or by implementing in real code in either exercise book or in programming IDE
Exam	Each course contains a final exam considering the complete syllabus. It should be a 3hours exam for 72 marks. Students need to answer at most 6 questions. Every question may include sub questions

Mapping of CLOs to Assessment

CIE- Continuous Internal Evaluation (40 Marks):

Bloom's Category Marks (out of 20)	**Test (30)**	**Attendance (10)**	**External Participation in Curricular/Co-Curricular Activities**
Remember	2		
Understand	5		

Apply	13		
Analyze	2		
Evaluate	4		
Create	4		

SE- Lab Final Exam (60 marks)

Bloom's Category	**Test**
Remember	**5**
Understand	**10**
Apply	**25**
Analyze	**10**
Evaluate	**5**
Create	**5**

Mapping of CLOs to PLOs

CLOs	**PLO1**	**PLO2**	**PLO3**	**PLO4**	**PLO5**	**PLO6**	**PLO7**	**PLO8**	**PLO9**
CLO1	1	1	1	0	0	0	0	1	0
CLO2	1	1	1	0	0	0	0	1	1
CLO3	1	1	1	0	0	0	0	1	0
CLO4	1	1	1	0	0	0	0	1	1
CLO5	1	1	1	0	0	0	0	1	0

Part D- Resources

Textbooks

1. *Horowitz, Sahni, Rajasekaran: Fundamentals of Computer Algorithms*
2. *Thomas H. Cormen, Charles E. Leiserson and Ronald L. Rivest: Introduction to Algorithms*

Reference Books

1. *Aho, Hopcroft and Ullman: The design and Analysis of Computer Algorithms*
2. *Sara Baase: Computer Algorithms: Introduction to Design and Analysis*
3. *D. E. Knuth: The Art of Computer Programming, Vol. 1, Fundamental Algorithms.*

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Course Outline: Database Management System

Part A- Introduction